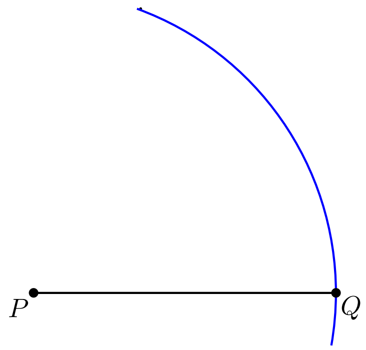
Compass and Straightedge Construction of an Equilateral Triangle

The material in this document is adapted from *PlanetMath*. (On that site, this type of triangle is referred to as a *regular triangle*.)

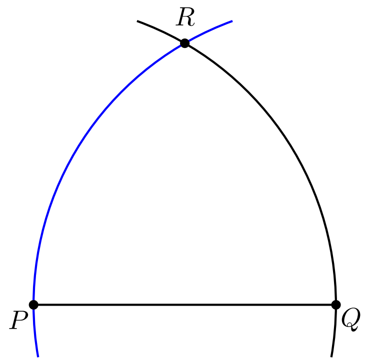
One can construct an equilateral triangle with sides of a given length s using compass and straightedge as follows:

(1) Draw a line segment of length s. Label its endpoints P and Q.

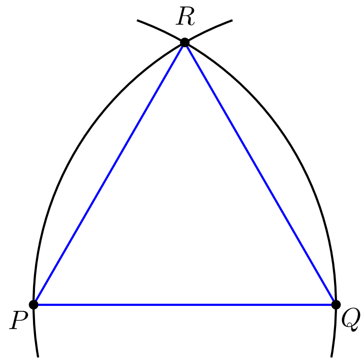
(2) Draw an arc of the circle with center P and radius $\overline{PQ}$.



(3) Draw an arc of the circle with center Q and radius $\overline{PQ}$ to find a point R where it intersects the arc from the previous step.



(4) Draw the equilateral triangle $\triangle PQR$.



This construction is justified by the following:

- $\overline{PQ} \cong \overline{PR}$ since they are both radii of the circle from step 2;
- $\overline{PQ} \cong \overline{QR}$ since they are both radii of the circle from step 3;
- Thus, $\triangle PQR$ is an equilateral triangle.

This construction is based off of the one that Euclid provides in *The Elements* as the first proposition of the first book.

This construction also yields a method for constructing a 60° angle using compass and straightedge.

Note that, with the exception of actually drawing the sides of the triangle, only the compass was used in this construction. Since equilateral triangles tessellate, repeated use of this construction provides a way to find infinitely many points on a line given two points on a line using just a compass.